

Smart water quality and consumption meter

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ABSTRACT

Although RO water purifiers are widely used for domestic water purification, most of them do not provide real-time information about water quality and consumption. This paper presents an IoT-based Smart Water Quality and Consumption Meter using an ESP32 microcontroller. The proposed system measures the Total Dissolved Solids (TDS) value of purified water and monitors water consumption using a flow sensor. The measured data is processed by the ESP32 and can be monitored locally on an LCD display as well as remotely through an IoT platform. The system is low-cost, user-friendly, and suitable for smart domestic water monitoring applications.

Keywords:- IoT, Smart Water Meter, TDS Monitoring, ESP32, Water Consumption

1. INTRODUCTION

Water is one of the most essential natural resources for life. The quality of drinking water directly affects human health.

Due to industrialization and pollution, contamination of water sources has increased. Traditional water meters measure only the quantity of water consumed and fail to monitor water quality.

2. PROBLEM IDENTIFICATION

Nowadays, many people purchase expensive RO water purifiers to obtain safe and clean drinking water. However, most of these commercially available purifiers do not provide a real-time display of Total Dissolved Solids (TDS) values. As a result, users remain unaware of the actual quality of the purified water they consume daily. Regular monitoring of TDS is important to ensure that the water remains within permissible limits for safe consumption. Due to the absence of continuous monitoring and display systems in conventional water purifiers, there is a need for a low-cost and reliable solution that can provide real-time information about water quality. To address this problem, the proposed system is designed to continuously monitor and display the TDS value of purified water along with water consumption.

3. LITERATURE SURVEY

Various studies emphasize the importance of monitoring drinking water quality to ensure safe consumption. Embedded system based water monitoring systems are widely used due to their low cost, reliability, and ease of implementation. Several researchers have proposed systems to measure water quality parameters and consumption using sensors and microcontrollers. Standalone monitoring systems are especially useful in areas where continuous internet connectivity is not available.

4. OBJECTIVES OF THE PROPOSED SYSTEM

The main objectives of the proposed Smart Water Quality and Consumption Meter are as follows:

1. To enable remote monitoring of water quality and consumption using IoT technology.
2. To continuously monitor the Total Dissolved Solids (TDS) value of purified drinking water in real time.
3. To provide users with a clear and real-time display of water quality parameters using an LCD display.
4. To measure the amount of water consumed using a flow sensor and promote efficient water usage.
5. To develop a low-cost and reliable embedded system suitable for domestic applications.
6. To increase user awareness regarding the quality of purified water supplied by RO water purifiers.
7. To design a portable and energy-efficient system using a rechargeable lithium-ion battery.

5. PROPOSED SYSTEM

The proposed Smart Water Quality and Consumption Meter is designed using an ESP32 microcontroller to monitor the quality and quantity of purified drinking water in real time. The system primarily focuses on

measuring the Total Dissolved Solids (TDS) value of water and the amount of water consumed. A TDS sensor along with a TDS sensor V1.0 module is used to measure the dissolved solids present in water, which indicates water quality. A flow sensor is employed to calculate the water flow rate and total consumption. The ESP32 microcontroller acts as the central processing unit of the system. It receives analog and digital signals from the connected sensors, processes the data, and displays the results on a 16×2 LCD display. The entire system is powered using a 3.7 V rechargeable lithium-ion battery with a charging module, making the system portable and energy efficient. A water pump and filter bowl water purifier are used to circulate and filter water through the system. This proposed system provides a low-cost and reliable solution for real-time monitoring of purified water quality and consumption.

The ESP32 microcontroller also supports wireless communication, enabling the system to transmit water quality and consumption data to an IoT platform for remote monitoring. This feature allows users to access realtime information using a mobile or web application.

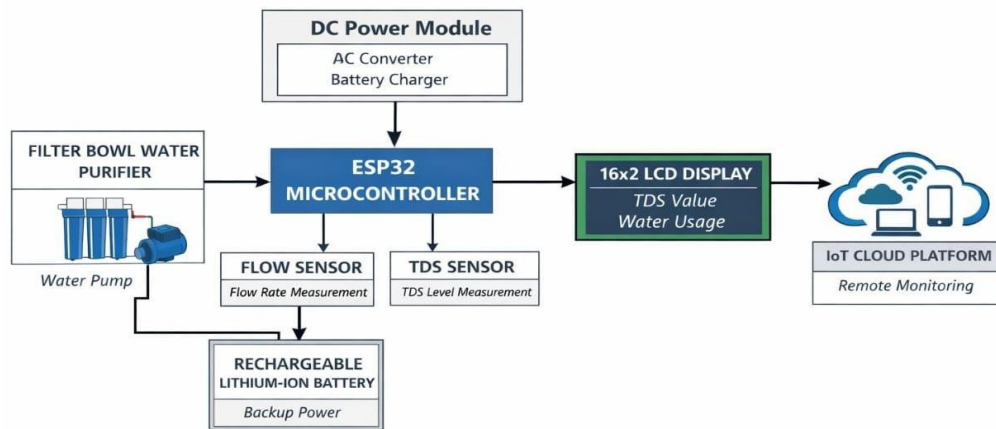


Fig. 1 Block Diagram of Proposed System

6. BLOCK DIAGRAM DESCRIPTION

The block diagram of the proposed system consists of the ESP32 microcontroller, TDS sensor with TDS module, flow sensor, LCD display, power supply unit, and water handling components. Water from the source first passes through the filter bowl water purifier to remove physical impurities. The filtered water then flows through the flow sensor, which measures the flow rate and total water consumption. After this, the water comes in contact with the TDS sensor probe, which measures the Total Dissolved Solids present in the water.

The TDS sensor module conditions the sensor signal and sends it to the ESP32 microcontroller. Simultaneously, the flow sensor sends pulse signals corresponding to water flow. The ESP32 processes these signals and calculates the TDS value and water consumption. The processed data is displayed on the LCD display in real time. The entire system is powered by a rechargeable lithium-ion battery through a charging module, ensuring continuous and stable operation.

7. SYSTEM ARCHITECTURE

The system is powered by an AC supply, which is converted into DC using a power supply unit before being supplied to the ESP32 controller and sensor modules..

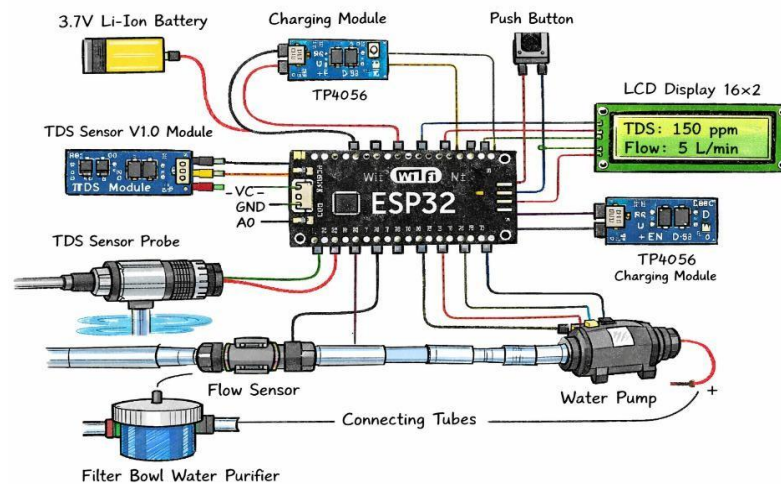


Fig. 2 System Architecture

8. WORKING PRINCIPLE

When purified water flows through the pipeline, the flow sensor generates pulse signals proportional to the rate of water flow. These pulses are received by the ESP32 microcontroller and processed to calculate the total water consumption. At the same time, the TDS sensor measures the Total Dissolved Solids present in the water and provides an analog output to the microcontroller. In addition to local display, the ESP32 transmits the processed data wirelessly to an IoT platform. Users can remotely monitor water quality and consumption data through a mobile phone or computer.

9. RESULTS AND DISCUSSION

The proposed Smart Water Quality and Consumption Meter were tested under different water flow conditions. The system successfully monitored the Total Dissolved Solids (TDS) value and water consumption in real time. The ESP32 microcontroller accurately processed the sensor data and the LCD display showed stable and readable values. The results indicate that the system is reliable for continuous monitoring of purified drinking water in domestic applications.

10. CONCLUSION

The IoT-based Smart Water Quality and Consumption Meter provide an efficient solution for real-time monitoring of purified water quality and usage. The system combines sensor-based measurement with wireless data transmission, allowing both local and remote monitoring. Due to its lowcost, simplicity, and IoT capability, the system is well suited for smart domestic water monitoring applications.

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12. REFERENCES

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